A Qualitative Study on Improving the Sizing, Fit and Comfort in Cycling Clothing for Plus-size Cyclists

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Abstract

There has been a steady growth from 1% to 5% in the rise of bicyclists post-pandemic. People have become more concerned towards their healthy lifestyles and environmental impacts. With the rising trend in cyclists all over the world, there are certain expectations of comfort that cyclists prefer. When it comes to preferences based on activewear used in cycling, female cyclists have more preferences than male cyclists in terms of fit and customization. With varied size ranges and body shapes, it is necessary to meet the needs of every individual who is interested in cycling. The research aims to study female plus-size cyclists and understand the issues faced by them and the product availability in the market. The qualitative interviews with four plus-size cyclists were done to understand their preferences based on sizing, fit, and other personal design elements to satisfy the needs of the growing market trends. Semi-structured interviews were conducted using video conferencing and the data collected was transcribed. The data is analysed using thematic analysis to derive themes from the perspective of plus-size cyclists and the challenges faced. Key findings include the importance of close-fitting and demure clothing, Standardizing sizes and size inclusivity, and enhanced comfort. Future research should focus on a wide range of size ranges to improve the plus-size female athletic market.

Keywords: comfort, female cyclists, sizing, fit issues, size-inclusivity, comfort

1. Introduction

According to the United States Cycling Federation, bicycling has increased by 350% since the 1980s (U.S.C.F,1980). There also has been increased participation of females in cycling activities either as a sport or a recreational activity ((Dickson and Pollack, 2000)).

Consumers' perspectives may change according to how they practice cycling either as a sport or as a recreational activity. Cycling, as it emerges as sportswear, breathability and waterproofing are features that add to the comfort. The choice of clothing also varies according to their use or the way they undergo cycling practice. Cycling clothing is also considered to be lightweight, and durable to provide protection against injuries. Garment detailing and design are critical while designing performance sportswear. The success of clothing for cyclists lies in the design improvisation over a period of time (Bramel (2005)). Cycling clothes is considered one of the significant elements for successful athletes. For some of the cyclists, their clothes represent their level of success as a cyclist Casselman-Dickson and Damhorst (1993). Many cyclists prefer comfortable clothing while cycling for either fun or for a recreational activity ((Dickson and Pollack, 2000)). Technical elements such as fit and protection become an essential part of sportswear.

Since the market for cyclists concentrates only on certain sizes, it becomes a hindrance for people of different body sizes to purchase clothing according to their fit. No major research has described the concerns of apparel fit for the plus size cyclists. With a focus on plus-size cyclists, the study investigates the preferences of better-fitted clothing to enhance the comfort and performance of cyclists. Cycling has come into focus after the steady global rise in different product categories for better fit, comfort and performance (Vuruskan (2019)). The plus-size market expanded but the standard sizes available did not perfectly fit athletes from different sports. As cycling is practised for longer hours and creates pain in the thighs, it is designed to perfectly fit and provide stretch without affecting the comfort of plus-size cyclist. The thermal comfort and ergonomics in cycling clothing have been discussed in the previous studies (Teyeme et al. (2022)). The discomfort was caused due to breathability and sweating that caused exhaustion.

Relatively little research has been conducted on plus-size market trends in cycling clothes. The perspectives of the plus-sizes in their choice of clothing are unheard of and not listed in the previous research. This paper examines the needs and challenges of plus-sized cyclists while purchasing cycling clothing and addresses the methods to eradicate them. Additionally, the research revolves around the fit for varied size ranges (2XL-8XL) including plus-size cyclists, bringing in reflections on the market of cycling clothing available in the market.

2. Related Work

The cycling wear is generally designed keeping in mind the men's comfort and choices (Winkworth (1989)). With increasing demand in the female cycling population and people enjoying the sport as a recreational activity, the need to expand the market size of the available size ranges also continues to rise. The purpose of the study revolves around the necessity of cy-

cling clothing to fit the sizes of the growing plus size cycling population and provide size inclusivity.

2.1. Cycling in the USA

The cycling population increased from 1% to 5% in 2018 and over the past decade. The COVID-19 pandemic was another reason in the spike in the number of people practising cycling either as a sport or a recreational activity (Buehler and Pucher (2022)). There was also a rise from 1.2% to 2.9% in people commuting to the workplace by bicycle (Buehler et al. (2020)). Cycling has gained popularity as a physical exercise since people have turned health-conscious making it a prospective point of research.

2.2. Active wear for cycling

The cycling clothing is generally made of elastane containing weft-knitted fabric with the torso and shorts perfectly fitted with the curves of the body. As the shoulders, elbows or arms are the main spots of injury while driving a bicycle, the torso/top wear should be considered keeping in the safety features of the bicyclist. Spacer fabric can help in protection against these injuries. The bicyclists prefer fitted cycling clothes with more pockets, a raglan armhole (to enhance the movement of the shoulder while driving), and a full-length zipper on the torso. In professional active wear for cycling, there are silicone-containing cushions that have been used in the shorts worn by professionals (Kara et al. (2021)). The problems faced included the improper fit at the waist, hip and shoulders due to the varied body shapes and sizes. The cyclists also had different choices for the shorts and the torso. It was also stated that the fit issues occurred at the crotch and thigh portion because of the riding position in cycling posture. The research also should include the design elements that the cyclists might prefer to enhance their performance (for example, breathable holes, cushioned butt pads or enhanced seam structure for stretchability) (Vuruskan (2019)).

Cycling is more comfortable with enhanced and softened pads on points of contact of the body feeling the stress. Most cyclists prefer comfortable and aerodynamic clothing which provides them with the exact fit and safety. The research should also empower the expectations of safety measures by plus-size cyclists. With regard to safety, the female cyclists were also concerned about their appearance. They also preferred that their clothes do not seek attention. As color is considered one of the main elements, the cyclists also chose light colors during dim light and bright colors in the daylight. Cyclists considered durability as one of the factors while purchasing their active wear. Fylan et al. (2020).Apart from fit, Steinhardt states, that thermal and weather protection should be considered while designing clothing for cyclists. The clothing should have appropriate ventilation such as meshes or zippers. Pattern changes were made by Steinhardt in her study to enhance comfort in the crotch and thigh portions to improve locomotion and comfort. The backrise was made stronger by adjusting the elasticity of the back panels. Therefore, the research concluded that better clothing improves comfort by adding additive elements and enhancing the fit. (Steinhardt (2010)).

2.3. Plus-size market

The apparel market for athletic wear is projected to rise at a rate of 3% every year. The plus-size market has risen to 21.4 billion with a growth rate of 6% every year (George-Parkin.H (2016)). With the increasing trend, plus-size clothes have gained importance, but there still remains a major void when people look for clothes that fit their exact body shape. The market ranges are available from XL-5XL for plus-size active/athletic wear (Richard (2023)). The garments are designed, not to be flattery but to provide the fit needed for the body sizes and shapes so that the cyclist feels confident while driving the bicycle. Teyeme et al. (2022) also suggested that there were difference in the sample sizes and the ready-to-wear brands. The size chart was questioned since they were not clear enough to eliminate the difference in sizing. This proved the significance of improvised size charts. There is no previous research that has addressed the fit of cycling clothing for plus-size cyclists. The challenges of the clothing have been only generally discussed. The potential to understand the market trend of the plus size cyclist and make them feel comfortable and confident during cycling is the motive behind the research.However, the research is developed by understanding fit problems faced by the plus size cyclists.

3. Study Objectives and Research Questions

As the previous research deals with specific features such as fit concerning female cyclists, safety and comfort for female cyclists, certain areas of research such as size ranges available in the market are neglected. The research aims to collect data from a wide range of plus-size cyclists (women) who find it difficult to choose the right size of clothing and the need for improved fit and comfort to enhance the performance of the plus-size cyclists.

3.1. Objective

This research goal contributes to a wide range of individuals with varied body sizes or shapes for cyclists. Since cycling is considered both a sport and a leisure activity, the clothing available should cater for the needs of all cyclists. To study the current issues faced by cyclists, it is important to get their suggestions about the fit and size issues aesthetics that are causing the problem. The objectives of the research include:

- To study the problems occurring with regard to fit and comfort
- To analyze the results for better-fitted cycling clothing

3.2. Research Questions

The research through qualitative data aims to solve the research questions listed below:

1. What are the issues faced by plus-size cyclists in terms of fit and comfort?
2. What are the perceptions of the current range of sizes available in the market for plus-size cyclists?
3. What are the design elements that can be incorporated to customise the fit and comfort of the plus-size cyclists?

4. Methods

4.1. Sample and procedure

Plus-size female cyclists were intentionally sampled and data were collected by conducting semi-structured interviews over Zoom video conferencing. The participants were asked to fill out a consent form, where information was provided to them about the confidentiality of the shared content. The interview was recorded and the audio recording was transcribed for future purposes. Each session with the participant lasted 35-45 minutes. To understand the fit and sizing of plus-size women, it is significant to understand the clothing trends and practices followed in the cycling sessions of plus-size cyclists. The questions asked to the participants should not affect their mental state and make them feel body-positive. For this purpose, the researcher applied to the university's institutional review board (IRB) to receive ethical consent for conducting interviews during the study. The IRB declared the study as a non-human subject research. After approval from the IRB, the researcher made recruitment flyers to recruit participants for the study. The recruitment flyers were posted on Reddit, social media platforms and other biking communities to bring to notice. Email invitations were also given to the biking communities to recruit participants. A $5 gift voucher was provided to the participants for their participation. Detailed questions about the cycling practices were asked of the participants to analyze the comfort factors, size expectations and market sizes. They were also asked to send in photographs of the daily clothing that they prefer to understand the fit of the garment. Notes were taken during the interview in a tabular format and referred to during data analysis.

4.2. Positionality

The researcher identifies herself as an Asian woman from India, a graduate student at the University of Minnesota, and as "straight-size". The researcher made sure that the questions asked to the plus-size cyclists did not affect them but instead helped them share their views on the challenges faced. The interview conducted made sure that their identity is confidential but their voices be heard through research. As a woman concerned about size inclusivity, the researcher acknowledges the women cyclists to come out and express their opinions to bring a change in the consumer market.

4.3. Semi-structures Interviews

The participants were asked to undergo 2 parts: A survey and an interview. The survey was used to collect demographic information about the participants. The survey was conducted using qualitrics and was filled out by each of the participants before the interview. The questionnaires included questions about the age, place, and age they started cycling. The interview consisted of questions about the fit of the plus-size clothes and the experiences of their cycling sessions. The purpose of the interview was to learn about the brands used by the plus size cyclists and understand the experiences or other challenges faced by the participants. The questions investigated how the participant considers cycling, the critical factors included during the cycling sessions, challenges faced while purchasing cycling clothing, and suggestions for improvement in cycling clothing. Participants also shared their conceptual views on how additional features on their cycling could help them During the interview, notes were taken according to Robert K. Yin's strategy and Strauss and Corbin (1998) of taking field notes or memos/diagrams (Yin (2015)).

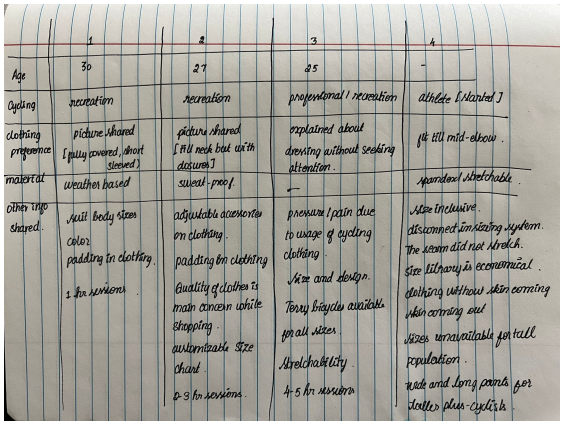

Figure 1: Notes taken in the form of keywords during the interview (Yin,2015)

The interview was designed with reference to the previous research papers and findings that addressed the interest in cycling clothing on female cyclists (Vuruskan (2019)). The questions in the interview conducted were based on the previous findings and also included the preferences of plus-sized cyclists since the market availability is still growing. The data was later transcribed using the Zoom audio transcripts and analysed for results.

4.4. Participants

Participants were plus-size female cyclists from different cycling communities in the USA. After posting recruitment flyers on the various platforms mentioned above, the participants were sent a qualitrics survey to understand their eligibility for the interview. After the filtration using the qualitrics survey, the participants were informed to sign the consent form after carefully reading the instructions. Four participants were interviewed during the process. Two participants practised cycling with friends and families. One participant was from the Eagle cycling community and the other participant was from the All Bodies On The Bikes community. They were chosen based on the eligibility criteria which included (1) Female above the age of 18 years (2) Female Plus-sized cyclists who are body-positive (3) enthusiastic to enhance the market ranges and fit of cycling clothes (4) have internet access and able to connect on zoom (5) a resident of the United States (6) provide a signed informed consent form. The mean age of the participants was 27.33 years with the range from 20-30 years. They came from different fields, for example, one of the participants was an information technologist, another one was a teacher, the third one was a part-time caregiver fourth participant was a teacher. The other demographic information is listed in the table below.

Participant	Age (years)	State	Martial Status	Ethnicity	Cycling since (age)	Size of Torso	Size of Trousers	Purchase Frequency
1	30	California	Married	White	Not Known	18	21	Quarterly
2	27	Los Angeles	Married	White	28	Did not mention	Did not mention	Once a month
3	25	NewYork	Unmarried	White	18	XL	XXL	Once a year
4	25-44	Colorado	Married	White	21	3XL	3XL	Once a year

Table 1: Demographic information of the participants

4.5. Pilot-interview

The semi-structured pilot interview (participant 1) was structured to know the participants better and their daily practices before their cycling session. The participants were also willing to share photographs of their preferred cycling clothing. This helped in understanding the views of the participants better than word of mouth. The participants also did not know technical terms when asked about the preferred material, where the question had to be either skipped or asked in an alternative method. The order of the questions had to be changed for the other interviews (participants 2,3 and 4) to bring in the flow of the participants answering the questions without thinking too long. The participants did not share their entire shopping experience of purchasing cycling clothing since they had no idea about the decisions they took beforehand. The other interviews (participants 2,3 and 4) followed a change in questions to elaborately explain the procedure or their experiences with cycling and cycling clothing. The interviews conducted afterwards, showed better results where participants showed complete interest and enjoyed sharing the experiences, the brands used and different challenges they faced during the cycling sessions.

4.6. Data Analysis

A thematic analysis was followed for the data analysis, where question prompts were used and the questions were categorised accordingly. The field notes taken during the interview were used to derive the codes from the audio transcripts.The researcher read through all the transcripts manually and divided them into segments of information with codes. Each of the codes were written on the sticky notes and grouped based on their similarities. These codes were connected used the affinity diagram and analyzed. Several codes helped in narrowing down the themes. There were initially 64 codes, where the overlapping codes were removed by the researcher and 45 codes were written (Creswell and Báez (2020)) .An inductive approach was used in data coding. The codes were written and themes and sub-themes emerged from the themes((Braun and Clarke (2006)).

5. Results

The qualitative study included participants sharing their experiences on the fit of plus-sized cyclists. The results discussed the difficulties faced by the plus size women during the selection of clothing for cycling and other difficulties faced while cycling caused by the cycling clothes. The participants expressed their experiences about shopping for clothes, which was uninteresting since they weren't able to find clothes for themselves. The desire for improvement was felt in all the interviews conducted. The study conducted revealed various factors affecting the fit and size of cycling clothes.

The section discusses the major themes that emerge from the participants' experiences with plus-size cycling clothes available in the market and the other perceptions of it. With focus on the fit issues and the other factors causing them, the themes and sub-themes were written. The three themes are (s1) Importance of fit: Close fitted clothing and Demure clothing (2) Size assessment: Size Inclusivity and Additive elements: Adjustability and Comfort

5.1. Importance of Fit

Fit was one of the most discussed among the participants. They shared the experience of the significance of fit while purchasing cycling clothes.The participants preferred perfectly fitted clothing but also chose clothes that did not seek attention and felt modest. The sub-themes gradually emerged from the opinions shared by the participants related to fit.

5.1.1. Closely-fitted clothing

When questions about the shopping experiences and the available market range for plus-size clothing were discussed. Two out of four (2/4) participants explained the significance of the closely fitted clothing for cycling.

"The clothing is not true to fit, the waist is either smaller or the hips are going to be bigger"- (P4)

Participant 4 was six foot tall and also plus-sized which made it difficult for her to find clothes in the market range. The need for closely or perfectly fitted clothing was essential to make her comfortable while riding the bicycle. She addressed the waist and hips to be points of concern which affected the fit of the cycling clothing.

"I have returned cycling clothes because it doesn't fit me"- (P1)

The participant addressed adverse conditions where she had to go back to the store again to return the product because the product did not fit her body, though she usually purchases the same size. The participant did not mention the size she shops.

When the researcher addressed the situation to be explained in detail, the participant was worried about the size chart that

each brand follows. It becomes difficult when the size chart of every plus-size clothing brand changes, they have to find a new one every time or wear it every time before purchasing.

"I prefer clothing which has fitted and till mid-elbow"- (P4)

The participant also mentioned that she prefers clothing with fitted sleeves to the mid-elbow. The fitted full-hand sleeves irritate while cycling. The participants talked about their perceptions of perfectly/ closely fitted garments and explained the challenges of loosely fitted clothing in cycling. The sub-theme discussed the various factors that affected the fit of the clothing and emphasized the need for closely fitted clothing.

5.1.2. Demure clothing

The interview with participants helped them understand the emotional connection with clothing. Two out of four (2 out 4) participants expressed how they feel when the clothing seeks too much attention. Participant 4 expressed that,

"The seam does not stretch properly. This fails to hold the boobs in place. There occurs a tight point, where it is difficult to stretch and the elastic ends up rolling back.....Since I am 6ft tall, and plus-size women are generally short, my sizes are not available in the market. I used to get men's clothing, which I find to be tighter across the legs, though they are long enough for the legs." -(P4)

The participant shared her experience where the participant felt her bust did not feel comfortable since the seams never aligned with her chest area nor did the seams ever stretch which made it uncomfortable to wear. Participant 4 also shared that, since she was six feet tall, she would wear men's clothing. But in the men's clothing, the chest area is tighter across the chest. She also felt that the clothing was not constructed in a manner that would make the plus-sizes wear comfortably.

"I need to dress smartly while riding a bicycle"-(P1)

For example, another participant also expressed her opinion about demure clothing, where she would prefer to dress smartly whenever she steps out for cycling. She prefers her clothing not to seek attention. The subsection shows that plus-size cyclists prefer their clothing to be modest and not attention-seeking. The sub-theme of demure clothing becomes an important factor to consider while considering the fit of plus-size cycling clothing.

5.2. Size Assessment

The participants shared about the sizes available in the market and the sizes they prefer to wear. The discussion also brought to attention their views on how sizes varied in different brands. Throughout the interviews, the participants shared experiences about how searching for sizes has taken most of their time while purchasing clothes and still return without purchasing. Therefore, the sub-themes of standardization and size inclusivity emerged to address their issues.

5.2.1. Standardization

The available market ranges were understood by asking the participants about the sizes they generally purchase and the choices available for them while purchasing the clothes. Two out of four participants explained the need for a standardized size chart enabling them to purchase clothes easily anywhere at any brand.

"Different brands have different sizes. The ranges generally vary from 3x to 6x. But none of the sizes is going to fit" -(P4)

The participant described in brief that the brands come with different size ranges, for example, she explained that one brand would have sizes from XL-2XL which they describe as plus-sizes, whereas other brands (participant mentioned Terry Bicycles) had plus-sizes in the range 3X to 6X. The confused sizes and differences in fit every time the clothing is purchased addressed the importance of size standardization.

"Since customizable sizes are a difficult option for mass production, a size library is an economical way for solving the problem"- (P4)

Participant 4 also suggested a size library as an economical way. As a part of the All Bodies on Bikes community, she talked about the different bodies of people from the community. For example, some cyclists are plus-sized and short, and some are plus-sized and tall like her. The expectations of every plus-sized cyclist may vary, so displaying all the sizes could become a hindrance. Thus, one piece of the size of each piece of clothing on the display could help satisfy the customers.

"I would prefer standardized size charts"- (P3)

When participants were asked about the sizes, they would go for, participant 3 expressed her opinion on better-standardized size charts for plus sizes since she spent time selecting the sizes on every purchase.The sub-section explained the participants' interest towards a standardized size chart to eliminate the time spent on looking for sizes in different brands.

5.2.2. Size Inclusivity

The size inclusivity concept evolved after one out of four (1/4) participants highlighted that cycling clothes could be made size-inclusive/gender-neutral.

"Usually plus-sized cyclists are short, unlike me, I am 6ft tall. So sizes are not available. I am self-conscious about the sizes.....I need men's length and women's sizes to not go up to fit my size"-(P4)

As already discussed in the previous sections, the participant talked about the particular brands and sizes that she would purchase. Since the participant addressed her height and the unavailable sizes in the market range, gender-neutral clothing was another adaptable option in cycling clothes. The sub-sections provide an overview of how all the sizes and bodies should be considered in the size ranges in the apparel market.

5.3. Additive elements

As participants talked about the sizing and fit issues, they also addressed other features that indirectly related to the fit of cycling clothes. The theme, additive elements discusses the two sub-themes: adjustability and comfort.

5.3.1. Adjustability

Adjustability involved the factors where participants discussed stretchability as one of the concerns in the clothing.

"The cycling clothing should not go till the neck, to avoid difficulty in breathing"-(P1)

The participants expressed different factors when they were asked about the problems they faced due to the cycling clothing. One participant highlighted the clothing that ran till the neck which at times led to difficulty in breathing when exhausted after a long cycling session.

"Appropriate closures (zippers) or other alternatives will make the clothing more comfortable"-(P2)

One participant also shared pictures showing the design and fit they prefer to wear. Closures were discussed by the participant to address the additive elements or improving fit in the cycling clothing. The sub-theme addressed comfort factors such as closures and style of the cycling clothing.

Figure 2: Image shared by participant 2, showing the expected fit and different closures in the clothing, with reference to the web

5.3.2. Comfort

Comfort factors included the materials that the consumers prefer and elements that they would prefer to improve the fit of the garment. Three out of four (3/4) participants addressed issues related to comfort.

"The material becomes uncomfortable when it starts to sweat"-(P3)"

Since the participant was more into long cycling sessions, she discussed about sweat absorbing material, when asked about the material of fabric preferred. She also talked about how she sweats a lot, and how it eventually changed the look of her clothing. This addressed the discomfort of the clothing after getting exhausted.

"The clothing should be comfortable on the legs while riding the bicycle"-(P1)

The comfort of the legs was discussed by the participant because the size of the seat and the space occupied by the cyclist need to be considered.

"I would prefer cycling clothing with padding to reduce friction while sitting, which is uncomfortable for a long ride."-(P2)

One participant when asked about the pressure points created while cycling, expressed the need for soft padding material on the butt, to provide comfort during her long time cycling sessions. The subsection addressed features such as stretchability, breathability and other factors such as material/ padding which affected comfort.

6. Discussion

In this study, the participants shared their opinions related to the size and fit issues in the current market range for plus-sized cyclists.

Theme 1 revolves around the significance of fit from the perspective of plus-size cyclist consumers. The researcher classified the fit issues the participants addressed into two subthemes: Close-fitted clothing and Demure clothing. The participants shared how researchers should take into a the functional clothing and aesthetic aspects of the clothing. As stated by Steinhardt (2010) in her research, cycling clothing is constructed tightly fitted for functional needs. The participants also stated the need for closely fitted clothing because they would functionally help while cycling without causing any kind of discomfort. The researcher was able to clarify the participant's opinions that they wanted their cycling clothing to be fitted and that the clothing should not make them feel embarrassed. The research conducted by Casselman-Dickson and Damhorst (1993) also suggested that the clothing should not bring emphasis or attract attention towards them. These factors add to the multi-faceted nature of cycling clothing for plus-size cyclists. The preference for modest clothing to avoid attention

aligns with the emotional connection. The researcher brought the issues into light to highlight the challenges existing and improving the plus size apparel market.

Theme 2 reflects the participants' struggles in finding appropriate sizes across different brands and their suggestions for addressing these issues. As participants expressed the need for standardized sizes in the market, Vuruskan (2019) suggestions align with the views shared by the participants. The study explained the constraints in the sleeve length, crotch fit, outerwear issues and collar size. One finding also delivered the same message of sleeve length, since it directly affected the movement of the arm while riding the bicycle. Standardized size charts should be implemented considering the participant's time spent on shopping. As participants mentioned certain brands they would purchase their clothing from, they also mentioned that they were not able to purchase from other brands due to the wide gap in the size range. The possible practical implication is to create a standardized size chart for the plus-size athletic market by 3D scanning the bodies of a wide range of bodies to fit the sizes of the majority of the bodies, similar to the hand scans conducted by Griffin et al. (2019) in her research to provide glove fit. One other practical implication for sizing in plus-sized cycling clothes would be implementing a size library. A size library would serve as an economical/ eco-friendly way of displaying sizes. Since bulk manufacturing of styles in all sizes for all the styles may lead to waste in productivity and time, the shops could display the range of sizes available and customize the styles based on the interest of the participant. The implication was based on the idea proposed by the participant who felt that there are a huge number of different types of bodies in the cycling community. The participant's mention of being 6ft tall and the difficulty in finding suitable sizes highlights the unique challenges faced by plus-size individuals. This further emphasizes the need for clothing options that aid a range of body types and sizes. Researchers should consider standardizing the size charts and emphasize size inclusivity. The feasibility of size libraries would serve to help the diverse needs of the plus-size market.

Theme 3 emphasizes the overall comfort and other elements that add to the fit of the cycling clothing. The experiences shared by the participants helped in understanding the holistic perspective concerning the fit and functionality of the cycling clothing. The participants shared the points of discomfort such as neck coverage, closures, material, leg comfort, and padding at the seating. The material preferences as discussed by the participants and Teyeme et al. (2022), should absorb sweat since the sweat either makes the clothing sticky or the clothing gets stuck to the body, which causes discomfort while cycling long-term sessions. Participants expressed the need for appropriate closures to ensure fit in the garment. A practical implication would be adding hooks or zippers to ensure fit and comfort while putting on the clothes. The participants' focus on stretchability at the bust and the crotch areas are some of the additive element that aligns with recommendations for addressing specific fit. The functionality of the garment complements both fit and comfort. Thus, the findings underscore the importance of considering not only standardized sizing but also the inclusion of features that enhance the overall user experience and addressing the other concerns about fit. Researchers should delve more into the insights fit of cycling clothing to enhance the overall comfort and performance of plus-size cyclists.

In terms of theoretical implications, Theme 1 identified the significance of the fit by analyzing the fit issues faced by the participants. Theme 2 analyzed the size ranges in the market range to enhance the experience for plus-sized cyclists. Theme 3 complemented fit and comfort to address the additive elements such as breathability and stretchability. This study will provide a framework to show the issues present in the plus-size athletic market and become evident to research further to provide design improvisations and improve the size charts. The research finding expands the market range reduces time in shopping for plus-size consumers and provides a standardized size chart to the consumers. The study will serve to eliminate the discrepancies in terms of fit and sizing for plus-size cyclists.

7. Limitations & Recommendations for future research

Given a short period, the research recruited only three participants to analyze the views and recommendations of plus-size cyclists. The participants were not diverse since the ethnicity was a majority white female population. For future studies, the number of participants should be increased, keeping in consideration the ethnicity, demographic location, experience and body sizes. The interview style could also be modified into a participatory design method (Simonsen and Robertson (2012)), where several participants can take part and explain their preferences more creatively, thus providing a platform to easily refine the results and develop more themes based on them. The quantitative method could be adopted to understand the link between dependent and independent variables (link b/w waist, hips, and bust to find what factor affects the size or fit of the clothing). The quantitative methods would help to compile the results accurately and justify them. 3D scanning a wide range of body sizes and measuring more bodies contribute to making standardized size charts and size-inclusive clothing.

8. Conclusion

In the study, in-depth interviews were conducted with four plus-size cyclists in the U.S. to understand of fit and sizing system available in the current market ranges and the perceptions of the cyclists. The main goal of the study is to understand the plus-size cyclists' perspective on the fit, sizing and comfort issues prevalent in the industry. The participants involved in the study were body-positive and shared their unbiased opinions throughout the interview. Findings suggest that plus-size cyclists have been facing difficulties while shopping for cycling clothes. The most important factor is the availability of fewer size ranges for the plus-size athletic market. Findings also suggest that providing a wide range of sizes to accommodate the rising female plus-size cycling market would positively impact plus-size consumers. Additionally, the participants also stressed the need for standardized size charts and size libraries

which would aid in size inclusivity. Importantly, this research also sheds light on the comfort factors as discussed by the participants. Factors such as a long neck, improper stretch at the bust, and pressure at the legs contribute to the discomfort. The research findings not only consider fit and sizing issues but also address the comfort factors that affect the fit and help enhance the performance. Future research can expand on these findings by quantitatively testing how dependent and independent variables waist, hips, and bust to find what factor affects the size or fit of the clothing. Additionally, future research should work on 3D scanning a wide range of body sizes and measuring more bodies to accurately improve the size charts for the plus-size female athletic market.

Appendix A. Interview Questionnaire

1. Can you briefly introduce yourself and where you are from?
2. When did you start cycling and how do you consider cycling? Do you practice it as a sport or a recreational activity?
3. What is your favorite cycling clothing and provide reasons? If they don't have one, you can ask them to describe any sportswear.
4. Describe the situation of them purchasing a new cycling clothing—where they do, how they start and make a decision etc.
5. Describe a situation when you returned items.
6. Describe any uncomfortable or dangerous situations caused by their clothing
7. What are the biggest differences between cycling clothing and regular clothing in terms of their criteria?
8. Do you experience any difficulties while cycling with regard to the clothing?
9. Do you face any issues after a long cycling session?
10. Can you describe what you wear for a short cycling session and the critical factors involved?
11. What material do you prefer the cycling clothing to be made of and why?
12. What are the factors that you consider while purchasing clothing for cycling?
13. What features (color, comfort, fit) do you feel could be improved in clothing worn by cyclists to enhance performance?
14. Do you find the cycling shorts or torso to create pressure in any of the parts of the body while cycling?
15. Can you find perfectly fitted cycling clothing in the currently available market range?
16. What are the sizes of cycling clothing that you purchase from the market and find closely fitted to the body?
17. What are the factors that you feel need to be improved in cycling clothing?
18. Are there any suggestions that you want to make it improve the fit/design of the clothing?

References

Bramel, S., 2005. Key trends in sportswear design. URL: https://api.semanticscholar.org/CorpusID:114974863.

Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. Qualitative research in psychology 3, 77–101.

Buehler, R., Pucher, J., 2022. Cycling through the covid-19 pandemic to a more sustainable transport future: Evidence from case studies of 14 large bicycle-friendly cities in europe and north america. Sustainability 14, 7293.

Buehler, R., Pucher, J., Bauman, A., 2020. Physical activity from walking and cycling for daily travel in the united states, 2001–2017: Demographic, socioeconomic, and geographic variation. Journal of Transport & Health 16, 100811.

Casselman-Dickson, M.A., Damhorst, M.L., 1993. Use of symbols for defining a role: Do clothes make the athlete? Sociology of Sport Journal 10, 413–431. URL: https://api.semanticscholar.org/CorpusID:145157291.

Creswell, J.W., Báez, J.C., 2020. 30 essential skills for the qualitative researcher. Sage Publications.

Dickson, M.A., Pollack, A., 2000. Clothing and identity among female in-line skaters. Clothing and Textiles Research Journal 18, 65–72. doi:10.1177/0887302X0001800201.

Fylan, F., King, M.J., Brough, D., Black, A.A., King, N.A., Bentley, L.A., Wood, J.M., 2020. Increasing conspicuity on nighttime roads: Perspectives from cyclists and runners. Transportation Research Part F: Traffic Psychology and Behaviour URL: https://api.semanticscholar.org/CorpusID:214296964.

George-Parkin.H, 2016. 68% of american women wear a size 14 or above - racked. (Accessed on 10/31/2023).

Griffin, L., Kim, N., Carufel, R., Sokolowski, S., Lee, H., Seifert, E., 2019. Dimensions of the dynamic hand: implications for glove design, fit, and sizing, in: Advances in Interdisciplinary Practice in Industrial Design: Proceedings of the AHFE 2018 International Conference on Interdisciplinary Practice in Industrial Design, July 21-25, 2018, Loews Sapphire Falls Resort at Universal Studios, Orlando, Florida, USA 9, Springer. pp. 38–48.

Kara, S., Yeşilpınar, S., Arslan, M., 2021. A survey and design study of a protective cycling top wear. Fibres Text. East. Eur 28, 31–45.

Richard, L., 2023. About our plus size and big and tall cycling gear — fat lad at the back. https://fatladattheback.com/en-us/pages/about. (Accessed on 10/31/2023).

Simonsen, J., Robertson, T., 2012. Routledge international handbook of participatory design. Routledge.

Steinhardt, L., 2010. Women's commuter cycling apparel : functional design process to product. URL: https://api.semanticscholar.org/CorpusID:110586638.

Strauss, A., Corbin, J., 1998. Basics of qualitative research techniques .

Teyeme, Y.W., Malengier, B., Tesfaye, T., Vasile, S.I., Ciocci, M.C., Van Langenhove, L., 2022. Users' perceptions on comfort level of cycling clothing, in: 7th International Symposium'Technical Textiles-Present and Future', Sciendo. pp. 11–16.

Vuruskan, A., 2019. Customers' perspectives on fit and customization of cycling sportswear: Cross-national comparison. TEKSTİL VE KONFEKSİYON URL: https://api.semanticscholar.org/CorpusID:191165927.

Winkworth, K., 1989. Women and the bicycle: Fast, loose and liberated. Australian Journal of Art 8, 96–121.

Yin, R.K., 2015. Qualitative research from start to finish. Guilford publications.